

REMARKS

This is in response to the Office Actions dated January 29, 2004 and September 24, 2003. Claims 1-8 and 15-20 are pending.

Section 112 Rejection

Claims 1-8 and 15-20 stand rejected under 35 U.S.C. Section 112, first paragraph. See page 2 of the Office Action. While applicant does not agree with this rejection, it is respectfully submitted that the changes to claims 1 and 15 address and overcome any potential issue in this regard. For example support for amended claims 1 and 15, see page 19, lines 12-14 and Fig. 5 of the instant application.

Claim 1 - - Section 103(a) Art Rejection

Claim 1 stands rejected under 35 U.S.C. Section 103(a) as being allegedly unpatentable over Krames in view of Saeki and Vakhshoori. This 3-way Section 103(a) rejection is respectfully traversed for at least the following reasons.

Claim 1 requires "a DBR (Distributed Bragg Reflector) and a light-emitting layer supported by at least a substrate comprising GaAs, the DBR being located between the substrate comprising GaAs and the light-emitting layer, wherein light directed from the light-emitting layer toward a top surface of the light-emitting device has a radiation angle dependence; a semiconductor layer formed over at least the light-emitting layer, a top surface of the semiconductor layer comprising a roughened surface which is not at least partially covered by the other semiconductor layers in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device; and

wherein no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened."

Vakhshoori is entirely unrelated to the invention of claim 1. In particular, claim 1 as amended requires that the top surface of the semiconductor layer is at least partially roughened in a manner which causes "light output from the light-emitting device to be diffused upon leaving the top surface of the device." Vakhshoori teaches the opposite of claim 1 in this respect. Instead of causing output light to be diffused as called for in claim 1, Vakhshoori uses a type of roughness for the express purpose of causing output light to be focused (see Fig. 2; col. 1, lines 50-55; and col. 3, line 55). Thus, it can be seen that Vakhshoori teaches direction away from the invention of amended claim 1 and is unrelated to the same.

Furthermore, the Examiner's allegation regarding a mirror function teaching of Vakshoori in the Advisory Action is incorrect. In particular, the Advisory Action states that "Vakshoori teaches that a mirror function can be obtained by a single layer (column 3, line 4), so that substitution of a DBR by a single layer would provide a functional device." The Examiner's interpretation of Vakshoori is wrong in this respect. In contrast to the incorrect statements in the Advisory Action, the mirror function can not be obtained by a single layer of a lower mirror alone as alleged by the Examiner because a p-type AlGaAs upper mirror is also disclosed at col. 3, line 8, which means that the device is an RCLED which is the opposite of what the invention of claim 1 requires. The very basis of the Section 103(a) rejection is based on a misunderstanding of the cited art,

thereby evidencing that the Section 103(a) rejection is incorrect and should be withdrawn.

In the Advisory Action, the Examiner relies on Fig. 13 of Krames for alleged diffusion. In particular, in the Advisory Action the Examiner contends that "diffusion, or spreading out, of the emission profile is shown in Figure 13 of Krames et al., for example, where the lobes of the profile indicate the spread." *The Examiner has misinterpreted Krames in this regard;* Krames discloses no such diffusion. In particular, the lobes in Krames indicate only the spreading spectrum of the emitted light from the active region (2) and they are not diffused because they have not yet reached the surface. Again, the basis of the Section 103(a) rejection is incorrect, thereby evidencing that the Section 103(a) rejection is incorrect and should be withdrawn.

Furthermore, Krames is also unrelated to other aspects of claim 1. In particular, claim 1 requires that "no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened." Krames fails to disclose or suggest this aspect of claim 1. Fig. 13 of Krames sandwiches a light emitting layer 2 between a pair of DBRs. Fig. 14 of Krames also requires a DBR 22 over the light emitting layer 2. Thus, it can be seen that all DBR embodiments of Krames use at least one DBR located over the light emitting layer so as to be provided between the light emitting layer and an overlying layer with surface roughness. This requirement of Krames is the opposite of what claim 1 requires. Krames teaches directly away from the requirement of claim 1 that "no DBR is provided between the light-emitting layer and the

semiconductor layer having the top surface that is roughened" and is entirely unrelated to claim 1 in at least this respect.

Saeki also is unrelated to amended claim 1. In particular, Saeki clearly fails to disclose or suggest the requirement of amended claim 1 that "a top surface of the semiconductor layer comprising a roughened surface which is not at least partially covered by the other semiconductor layers in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device." Saeki teaches directly away from this aspect of claim 1, as Saeki requires many layers over top of the roughened portion in Fig. 8B.

The Final Rejection contends that it would have been obvious to leave out the top DBR of Krame's device, as allegedly taught by Saeki. This contention made in the Final Rejection is respectfully traversed. In Krame's Fig. 13, there is disclosed an RC (resonant cavity) LED. In this type of LED, the active layer is positioned within a small vertical *cavity defined by the pair of sandwiching reflecting DBRs (mirrors)* (col. 6, lines 6-16 of Krames; or http://photonics.intec.rug.ac.be/download/pub_295.pdf). This means that an RCLED must have both an upper DBR and a lower DBR surrounding the active layer to function properly. Thus, it can be seen that one of ordinary skill in the art would never have removed Krame's top DBR as alleged in the Final Rejection because to do so would destroy the RCLED with respect to purpose and functionality.

In contrast to RCLEDs, claim 1 expressly excludes RCLEDs by stating that "no DBR is provided between the light-emitting layer and the semiconductor layer having the

top surface that is roughened." In other words, the device of claim 1 has no upper DBR, and functions quite differently from Krame's RCLED. Thus, one of ordinary skill in the art would never make an RCLED as in Krame without a top DBR as alleged in the Office Action, because removal of the top DBR would destroy the RCLED itself.

With respect to the Examiner's contention that Vakshoori has a mirror function obtained by a single layer, this is incorrect. While a n+ AlGaAs mirror is disclosed by Vakshoori at col. 3, line 4, a p-type AlGaAs upper mirror is also disclosed at col. 3, line 8. Thus, in direct contrast to the Examiner's unsupported allegation, the mirror function in Vakshoori is achieved by a pair of mirrors – not a single mirror. Again, the very basis of the Section 103(a) rejection is incorrect. The Section 103(a) rejection should be withdrawn for this additional reason as well.

Claim 15 - - Section 103(a) Art Rejection

Claim 15 states that "a roughened surface which is not at least partially covered by the other semiconductor layers in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device; and wherein no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened." The cited art fails to disclose or suggest these aspects of amended claim 15.

KURAHASHI et al.
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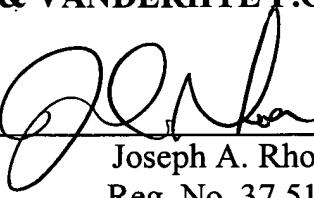
Conclusion

For at least the foregoing reasons, it is respectfully requested that all rejections be withdrawn. All claims are in condition for allowance. If any minor matter remains to be resolved, the Examiner is invited to telephone the undersigned with regard to the same.

Respectfully submitted,

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